

Helmholtz Analytics Framework

Joint effort of all 6 Helmholtz centers

Aim: foster data analytics within Helmholtz



HelmholtzZentrum münchen
Deutsches Forschungszentrum für Gesundheit und Umwelt



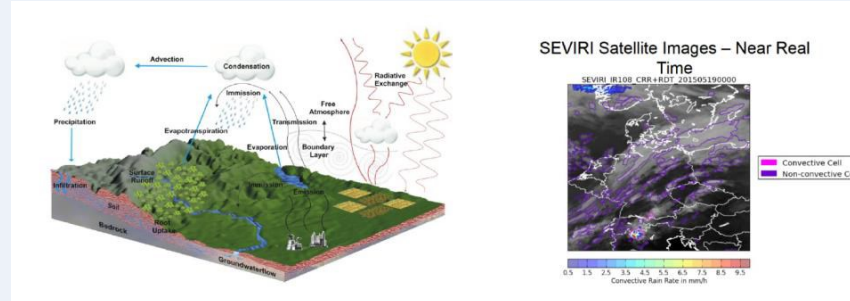
Systematic development of domain-specific data analysis techniques in a co-design approach between domain scientists and information experts

Common components for data analysis

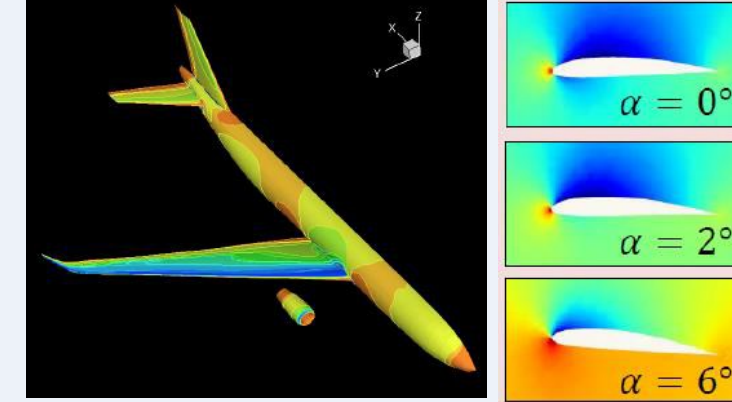
- Generalizing and standardizing data analytics, machine learning and deep learning approaches for high performance computation

Guided by use cases from different scientific fields

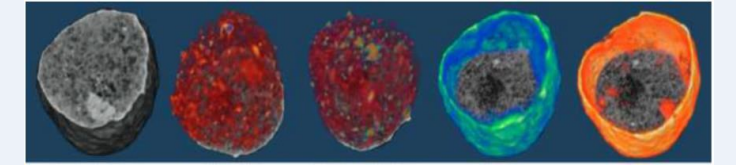
Earth System Modelling



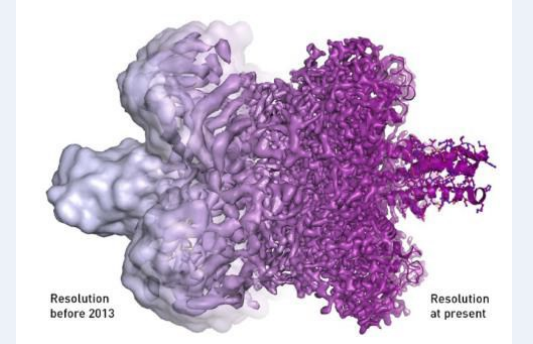
Aeronautics and Aerodynamics



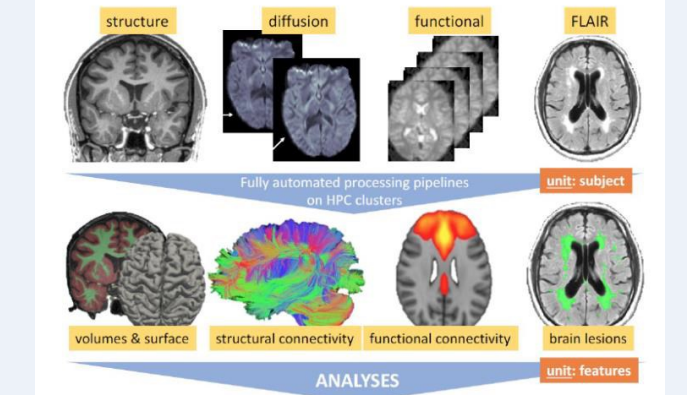
Research with Photons



Structural Biology



Neuroscience



- Facilitating use-cases by identifying and providing common components for data analysis
Clustering, Uncertainty Quantification, Dimension Reduction, Feature Learning, Data Assimilation, Classification / Regression, Modelling, Optimization Techniques, Hyperparameter Optimization, Interpolation, Data Mining

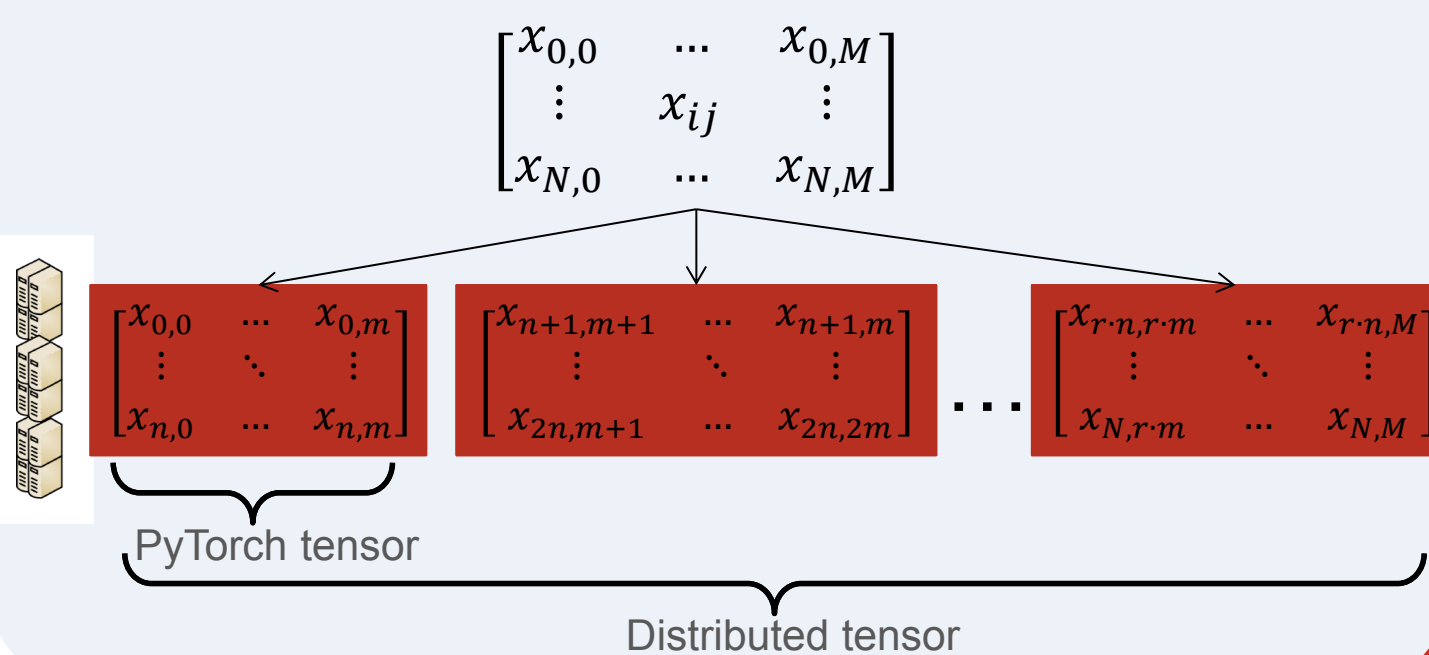
Helmholtz Analytics ToolKit

Scientific data analytics library for HPC systems
build on top of PyTorch

Operates on heterogeneous hardware like GPU/CPU systems

Allows computation on distributed systems

Distributed tensor data object: operations like basic scalar functions, linear algebra algorithms, slicing or broadcasting operations



Facilitating Use Cases
in their work

Bringing HPC and Machine
Learning / Data Analytics
closer together

Ease of use



k-means

SVM

NN

⋮



Tensor Linear
Algebra

Automatic
Differentiation

Pythonic numpy –
like interface

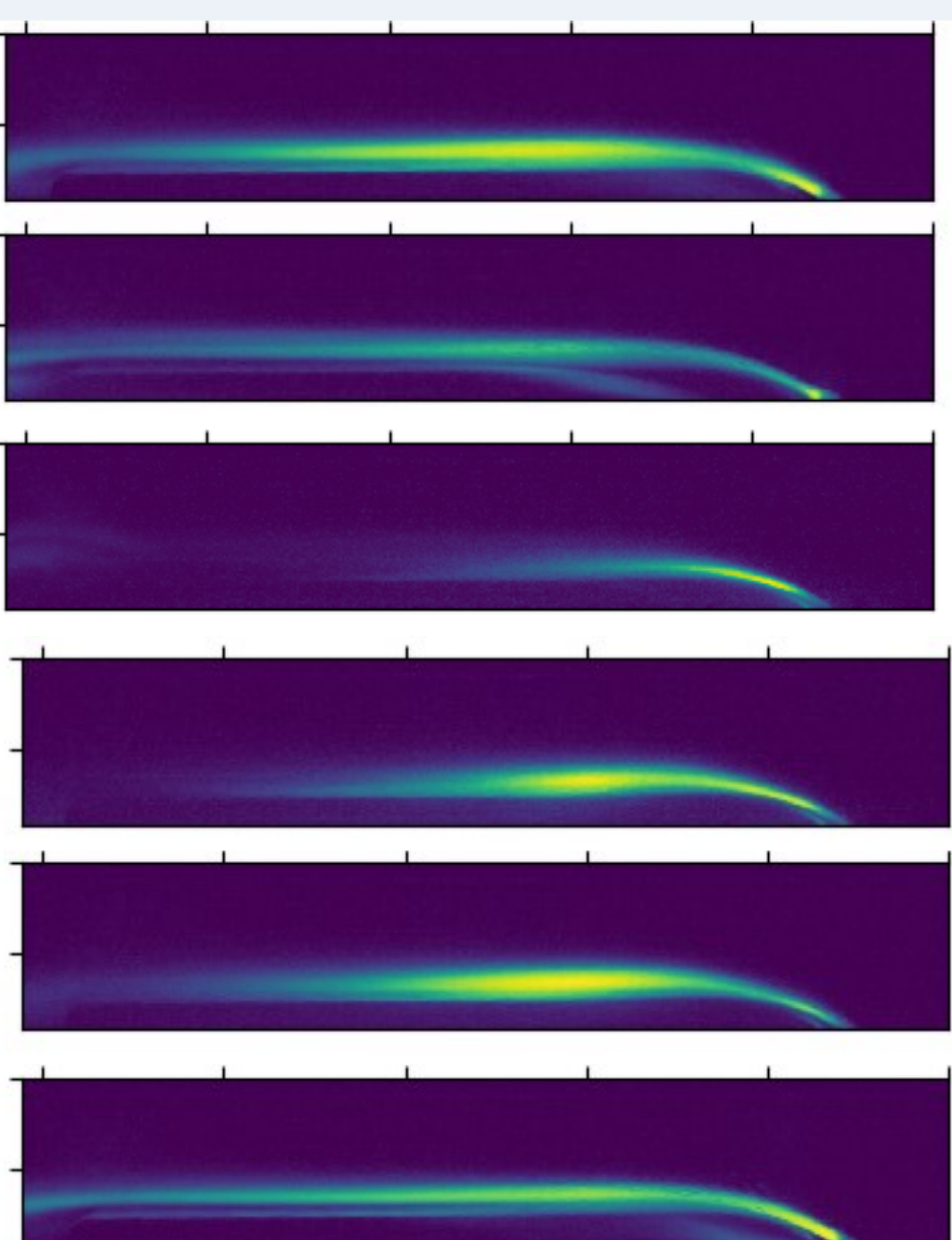
GPU support



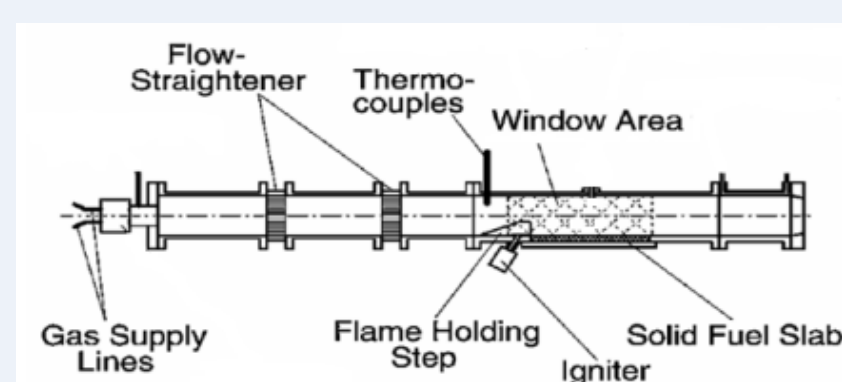
Distributed Parallelism (MPI)

Clustering of Combustion Data

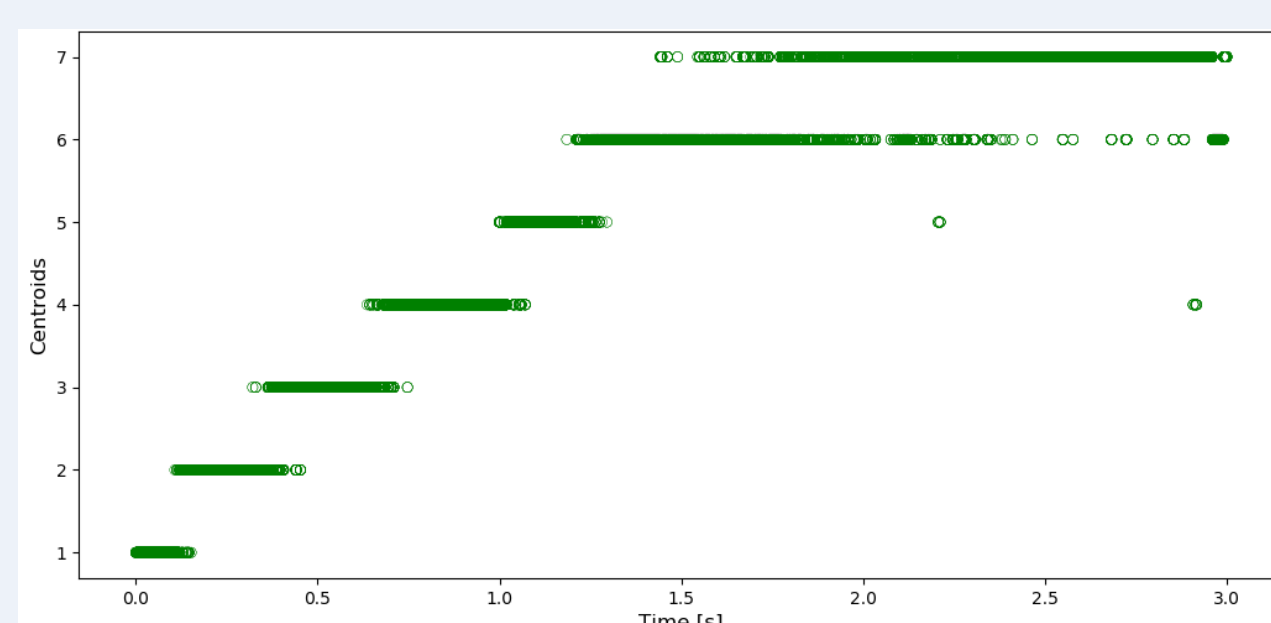
Hybrid rocket engines: paraffin-based fuel
with gaseous oxidator



Combustion tests at DLR Institute of Space Propulsion
Super-high resolution video camera (10 000 images /
second)



Clustering of Images for identification of combustion
phases → Kmeans



Open Source

<https://github.com/helmholtz-analytics>



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